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ABSTRACT

This report presents the results and recommendations of a study undertaken to aid the Republic of Kenya's National Council for Science and Technology (NCST) in the development of a National Documentation and Information Centre to coordinate existing research and development (R&D) information services. The background of the NCST and its relationship to the R&D community in Kenya is reviewed, the NCST's views of the objectives and role of an R&D information center are presented, two earlier UNESCO reports on the establishment of information centers in Kenya are summarized, the functions of the Regional Committee for the Development of Information Services in Eastern Africa are outlined, and existing documentation services and libraries in Kenya are described. Computer facilities available in Kenya for information and documentation service purposes are listed and some of the general questions surrounding the development of national information services are addressed. A set of 25 recommendations are then presented, grouped in three broad categories: (1) organizational objectives and structure, (2) the center as a force in the development of other information services, and (3) staff, consultants, and funding. A 57-item reference list and three appendices accompany the text. (JL)

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KENYA

A NATIONAL DOCUMENTATION AND INFORMATION CENTRE OF THE KENYA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

by Stephan Schwarz

Report prepared for the Government of Kenya by the United Nations Educational, Scientific and Cultural Organization (Unesco)

UNESCO

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PREFACE

At the request of the Government of the Republic of Kenya, the Director General of Unesco arranged, under the Organization's Regular Programme for 1979-1980, for a consultant to visit that country from 3 September 1979 to 17 October 1979 to advise on the development of scientific and technological information systems. As one task of the mission, which is the subject of the present report, the consultant was required to provide approximately four weeks' advisory services to the National Council for Science and Technology for the development of a National Documentation and Information Centre. The Consultant was specifically asked to consider problems of coordination of existing information resources; development of information services and document collections; and training of needed manpower for the Centre. He was also requested to prepare detailed recommendations with a view to future international assistance in establishing the Centre.

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I. THE NCST AND THE R&D COMMUNITY IN KENYA

1. The National Council for Science and Technology was established in March 1977 by an Act of Parliament (ref 1) after a formation process dating back to 1964. A Unesco Expert was engaged (from June 1971 until August 1977) as a Science Policy Adviser to the Government of Kenya under the UNDP-assisted project KEN/71/005. His primary task was to assist in developing an appropriate design for an advisory and co-ordinating body dealing with research in science and technology, and its applications in all sectors of society. The Terminal report on project KEN/71/005 (ref 34) gives a brief account of circumstances which influenced the choice made among the following options:

   1) A Bureau for Science and Technology in the Ministry of Planning
   2) A Ministry for Science and Technology
   3) A National Council for Science and Technology as a statutory body.

2. The responsible authorities agreed that the last mentioned choice was the most appropriate. The Science and Technology Act (ref 1), based on this principle, lists a long series of tasks assigned the Council for the promotion of research and development (R&D) activities and the application of their results. It was, however, decided that the Council "would have limited powers for direct execution of its policies, being primarily advisory and dependent, even as a statutory [body], on the sense of obligation of its members, particularly those who have the executive powers in their individual ministries, to implement the open decisions made at its various levels" (ref 34, p. 15).

3. The cross-departmental and interdisciplinary character of the matters to be handled by the Council is reflected in its membership, which consists of Permanent Secretaries of fourteen scheduled ministries and twelve scientists representing the following sciences (ref 1, p. 7):

   a) agricultural and allied sciences
   b) physical sciences (including chemical sciences and mathematics)

c) industrial sciences, engineering and technology
d) medical sciences (including pharmacology)
e) natural sciences (biosciences and geosciences)
f) social sciences.

This structure is specifically designed to provide a "comprehensive basis for discussion and consensus-making" and to leave "R&D co-ordination and management of scientific and technical services closely related to the ministries most concerned with their application to their socio-economic objectives" (ref 34, p. 15).

4. The R&D system in Kenya is of fairly recent origin; it dates back to the turn of the century. A brief history is given in ref 34. Agricultural and veterinary research laboratories were established before 1910. The Medical Research Laboratory was set up in 1958. The Institute of Development Studies (1965) was the first major step towards the introduction of social sciences. Industry is to a large extent "still dependent on imported technology" (ref 34), in spite of the creation of several specialised institutes, e.g. in materials testing and processing. Basic research was centred on biology and palaeontology until the 1960's, and was primarily based in museums.

5. The Science and Technology (amendment) Bill of March 1979 (ref 2), established five new research institutes:

The Kenya Agricultural Research Institute
The Kenya Industrial Research and Development Institute
The Kenya Marine and Fisheries Research Institute
The Kenya Medical Research Institute
The Kenya Trypanosomiasis Research Institute.

At the time of writing, no further information was available concerning the relationship of these institutes to existing ones, or concerning relevant finance, development programmes, planning and implementation.

6. The University of Nairobi was formally established in 1970, but was based on older institutions with technical and commercial orientations, set up in 1947 and 1961. The Commonwealth Universities Yearbook (ref 6) lists the institutions and staff within the University and its constituent college, Kenyatta University College, founded in 1972. Further data on the Faculty of Science (University of Nairobi) are given in the 1978/79 Catalogue (ref 13) and in the directory of research grants entitled "Research within the University 1973-1976" (ref 12). The latter lists 240 projects (with about 250 project-responsible scientists) funded by grants authorized by the University Research Grant Committee. From conversations with Kenyan scientists it appears that teamwork, at least in academic research, is relatively rare, a feature which probably will change with the growth of the R&D system.

7. Statistical studies on the R&D system were carried out in 1970 and in 1975 (ref 11), the latter having been conducted by the Unesco Consultant on science policy. Although rigorous comparisons cannot be justified (since the earlier study was much less comprehensive), higher education programmes obviously have resulted in a considerable increase of trained manpower. For "scientists" a figure of 3,000 is given for 1970 (ref 34, p. 7), and for 1975 a figure of about 5,100 is given (ref 11, p. 29). However, the definitions used, following the Unesco recommendations for science and technology (S&T) manpower studies, count as a scientist, engineer or technologist ("class S"), all individuals having received an undergraduate training or non-academic training qualifying for a professional career. (For difficulties in finding S&T indicators in developing countries cf also ref 55). Only part of "class S" would therefore have experience in using research literature in an independent (non-instructed) context. Only a small fraction of the "S"-group are actually involved in R&D activities proper; there are probably not more than 1,000 such scientists in Kenya (an estimate of the present author supported by tables given in ref 11).

8. The university mainly operates at the undergraduate level and has very limited resources for postgraduate training (master's and doctoral levels). A majority of doctorates are obtained from foreign universities after scholarship-financed studies abroad. Within the total current research output in

science and technology, a dominant part may be regarded as applied or development work. University research also frequently includes some applied research, which certainly is related to the sources of research funds and to the procedures of grant-allocation.

II. NCST'S VIEWS OF THE OBJECTIVES AND ROLE OF AN R&D INFORMATION CENTRE

9. Co-ordination of R&D information services for the R&D community and for all kinds of applications of research results in society is a fairly recent approach (see for example the Swedish Government Committee report, ref 54). The need for such co-ordination is brought about by the growth of the scientific literature, the interdisciplinary character of both research and practical scientific and technological problems, and the advent of sophisticated (computer-based) techniques for information storage and retrieval. In early discussions concerning the role of a National Council for Science and Technology, the co-ordinating functions for information and documentation services were stressed by including "for Research and Information" in the name of the Council (ref 35).

10. It is obvious that an efficient information and documentation service providing timely access to any kind of scientific and technological information, available either locally or through the international network of information systems and services, is a prerequisite to the fulfilment of the numerous tasks assigned to the Council, its advisory committees and its secretariat (ref 1). The NCST "Committee on Documentation and Information " (operative since January 1979) has presented a "project proposal" for the establishment of a National Documentation and Information Centre" within the NCST organization. The Centre should respond not only to the needs of the Council itself, but also undertake a much wider scope of co-ordinating and operational functions to serve the entire R&D community in Kenya, and other users of scientific and technological information (ref 8).

11. Preliminary ideas and the subsequent project document have been discussed at the meetings of the Committee (ref 7). There has been an obvious concern that the Centre should not interfere with the mandates and activities of

existing institutions such as the University Library, the Kenya National Library Services, the National Archives, the Kenya Agricultural Documentation Centre, and the Library Association of Kenya. It was, therefore, agreed as a principal policy that the Centre should "form a basis for co-ordination and perform such tasks that are currently not being undertaken by the existing information services in the country" (ref 8 p. 3). This principle is based (according to the present consultant's understanding) on the assumption that agreements can be reached on the division of responsibilities for (and funding of) a comprehensive set of R&D information services with a minimum of overlapping. This type of structure implies the existence of mechanisms for policy analyses, for assignment of responsibilities and for control and initiation of corrective mesures whenever necessary.

12. The following lists of tasks is included in the project document (ref 8), to be performed "within the scientific information network, in collaboration with other documentation and information establishments":

a) to guide, co-ordinate and supervise documentation and information services in the country;
b) to compile a directory of important libraries and documentation centres in the country, with the functions they perform;
c) to compile an annual list of periodical holdings of important libraries in the country;
d) to compile a directory of on-going and completed research activities, together with a directory of subject specialists in science and technology;
e) to publish a bibliography of scientific literature of Kenya;
f) to work out standards to be followed by all participating information establishments in order to perform tasks (a) to (d) above;
g) to establish a referral service for science and technology information;
h) to develop the necessary manpower to staff the documentation and information services of the centre;
i) to establish documentation services to process research reports and papers collected or received from the Research Clearance Committee;

j) to provide library services, through which books and other reading material received by the NCST will be made available to authorised users;

k) to establish a current awareness service to provide selected users with information on the literature published in their field of interest. Towards this end, users and potential users of the service will be identified;

l) to provide exchange services, through which publications of the Centre will be exchanged with those of similar centres, either within the country or abroad; to facilitate this, an acquisition list of the Centre will be published;

m) to provide an information analysis service to evaluate research reports and papers received through the activities of the Research Coordination Committee;

n) to provide translation services for science and technological information;

o) to establish reprographic services to provide users in the country with copies of materials available in the Centre.

13. There are five principal groups of activities in this list:

1) Policy-oriented work on information service and manpower development (a,f,h).
2) Activities to promote sharing and use of scientific and technological information resources (b,c,d,e).
3) Referral and retrieval services (g,k).
4) Library operations (j,l,o).
5) Information services in support of NCST and its committees (i,m,n).

14. This is a very comprehensive programme, which should be seen as a framework for the development of a national network of information and documentation services linked to international information sources and services. The exact significance of each item (which will also evolve over time), and the distribution of responsibilities for implementation still have to be specified in operational and budgetary terms, and the objectives have to be related to the user community and to the development of user needs.

15. For this purpose, questions have to be raised on how "science and technology" should be delimited, what kinds of information should be handled and which user groups should be served. Considering the functions of the NCST (ref 1), it seems reasonable to accept the following working definitions:

a) Science and technology: The concept of "science" is understood in a very wide sense. In the combination "science and technology" it comprises, apart from areas normally included in natural science faculties, the medical sciences (including dentistry and veterinary medicine), the agricultural sciences, all types of engineering, most applied research and development associated with industry, and the social sciences. This view is reflected in the statutes of the National Council for Science and Technology (ref 1).

b) Information: This concept should be carefully defined so as to avoid confusion. As regards an information and documentation centre, the information provided is the content of the materials (documents, bibliographies, data, etc) supplied in response to a request. Only the user can assess the comprehensiveness, relevance and consistency of this material, since his needs are determined solely by his own research problem. Improvement of information supply is achieved by a process of feedback, whereby the user response is taken into account in subsequent searches. "Information" in the present context will therefore denote materials pertinent to S&T, and disseminated within the (international) scholarly or professional community, delimited by the above definition of "science and technology".

16. Even after adopting the above definitions, there remain users with a wide range of information needs like:

- policy-makers in R&D (Ministries, NCST and its Committees, Research Councils, research institute managers)
- administrators (in S&T-related enterprises or services)
- committees (with S&T-related duties of inquiry)
- research staff (universities, research institutions)

- students (college, undergraduate, post-graduate)
- professionals (medical doctors, engineers, industrial scientists, etc)
- practitioners (in applied areas of S&T)
- general public (seeking general knowledge on S&T, or information on matters of specific concern)
- documentation officers (performing searches requested by the other categories of users).

17. With respect to the "international" S&T literature, there are a number of relatively straightforward techniques to search and obtain access to S&T literature and to disseminate this information in its original form to local R&D communities. Literature here means R&D documents published in professional journals, in the informally published or "grey literature" (which is much more difficult to retrieve and access), and digested literature (reviews, monographs, textbooks). The management of these kinds of information is facilitated by numerous bibliographic instruments, such as abstract journals and associated bibliographic data-bases.

18. On the other hand, any kind of manipulation of the content of this literature, such as evaluation, "re-packaging" for non-professional users, management of numerical data, or analysis of primary information from surveys, leads to extremely difficult problems. In any given case, extreme care must be taken to define the scope of such work, and to assess the cost-effectiveness of information service operations. Furthermore, it is necessary to decide on an appropriate allocation of responsibilities for the management of such services. The NCST stance in this matter is not made explicit in the discussions of the Committee (ref 7), nor in the project document (ref 8). Considering the objectives and tasks of the Centre, and also the needs of the organizations represented on the Committee, it would be reasonable to restrict information activities, at least initially, to the existing scientific and technical literature (as discussed in para. 17) and to user groups in a position to assimilate the contents of such literature.

19. The particular case of producing reviews of scientific areas for policy makers is, however, clearly within the duties of the NCST secretariat and

could be delegated to the Documentation and Information Centre as a special task.

20. The wider goal of making research results widely accessible outside the R&D community has not been discussed in the Committee. It will have to be attained by means of a larger network of information services than the one discussed here, including the extension services, the secondary education system and the various programmes for adult education. In this context, the following opening remarks made by Professor Mungai, Chairman of the NCST, at a recent conference (ref 10, p. 1), should be noted:

"One of the biggest problems in a developing country like Kenya is that research information does not reach the people who really need it. It tends to be concentrated among the educated and urbanized communities in relation with the modern sector of the economy. While this is desirable, the great majority of people living in the rural areas receive little or no information from research results. This is because such knowledge is not adequately translated and transferred in a form that can be used by them. In fact this remains one of the biggest challenges to scientific work."

III. THE GEHRKE REPORT (ref 35)

21. In December 1974, Dr U. Gehrke carried out a three-week Unesco mission to Kenya in order to "advise on the establishment of a national documentation centre in Kenya". The following guiding principles were proposed by the consultant:

"1. The envisaged national Information and Documentation (I&D) System should be organized so as to answer directly the information requirements of research, administration and other public sectors (i.e. in contrast to older views which considered I&D solely or primarily as a service instrument for research which, in turn, would or would not communicate its results to practical users in the administration, economy, etc).

2. It should be demand-oriented, i.e. reflect the goals and priorities of the development policy of the country.

3. It should be designed in such a way as to make the widest use of international I&D facilities in order to avoid duplication and to make the knowledge of the outside world available to Kenya". (Ref 35)

22. The approach implicitly identified the concept of information with "documents in libraries and archives and associated bibliographic instruments". Within this framework, the analysis was on a quite general level, i.e. without breakdown into a structure of subject areas, information services and user groups and subsequent analysis of problems of information provision.

23. The main idea was to create a body (the Kenya National Documentation Centre) which would be "accorded power to co-ordinate all I&D activities of Government or Government-sponsored institutions", thereby "ensuring an optimal use of available resources" in a completely decentralized structure based on the existing institutional framework. The Centre would operate departments for

"a) central co-ordination and planning
b) central reference and publication
c) standardization and regional and international co-operation
d) information analysis and sector co-ordination
e) technical equipment and electronic data processing"

24. The planning would be based

"a) on a comprehensive survey of existing national documentation, library and archives resources and

b) on a detailed analysis of the information needs of the government for its tasks and of the various groups of users in such areas as industry, research and education (users analysis) in order to ascertain demand profiles and optimal forms of information service (1))."

25. Among the recommended operational tasks were compilations enabling resource sharing (union catalogues, directories of research projects) and development of new techniques (including computer-based techniques) for documentation services and library management.

The Centre was to be placed under the Ministry of Finance and governed by a committee similar in some respects to the NCST (not yet in existence in 1974). As intermediaries for planning and implementation, there would be two co-ordinators, for the academic and the "government" sectors respec-

tively. Presumably, these co-ordinators would be in a position to commit the corresponding I&D service centres to decisions taken by the steering committee of the National Centre.

26. It seems that a deeper analysis of the implications of this suggested organizational model would be necessary in order to assess its viability. Obviously, there is a conflict between the central coordinating function and the distribution of budgets and executive power within the elements of the network. It may be that the NCST-based Documentation and Information Centre discussed in ref 7 and 8) which is also planned as a de-centralized construct, avoids these problems to some extent. It should be pointed out however that the scope of the NCST Centre is limited to scientific and technological literature and to its immediate users, and this limited set of participants with basically similar objectives, methods and working conditions entails a less serious co-ordination problem.

IV. THE POLINIÈRE REPORT (ref 37)

27. In a seven-week fact-finding mission to Burundi, Kenya, Rwanda, Tanzania, Uganda and Zambia in late 1974, a Unesco consultant studied the conditions for the establishment of national information systems in science and technology. The approach taken was strongly functional and user-oriented, and mainly based on interviews with officials. Analysis was undertaken in terms of a unified structure encompassing:

"the agriculture information systems
the manufacture information systems
the function-oriented information systems, and
the national information systems"

and a substructure exemplified, in the case of agriculture, by the sequence:

- farmer's information needs and problems
- information dissemination to farmers
- information dissemination to disseminators
- co-ordination of the farmer's information system
- the policy-makers' information system

- the researchers' information system
- the students' and educators' information system
- co-ordination of the agricultural information system

28 It seems that, in this approach, the concepts of "information" and of "co-ordination" vary greatly among the several countries and functions considered, and it is therefore difficult to make a synthesis of the various views expressed. The study, however, shows that the particular case of "information and documentation services for science and technology and its applications" is only a specific, albeit important, component of "information provision" in general. Another point suggested by the report is that information services cannot meaningfully be introduced without full consideration of the problems of information use. The "lateral" flow of information discussed in the report, which involves "repackaging" and other kinds of rearrangement of information content, is very different in scope and operation from the more traditional information and documentation services for R&D proposed for the NCST Centre.

V. THE REGIONAL COMMITTEE (COUNCIL) FOR THE DEVELOPMENT OF INFORMATION SERVICES IN EASTERN AFRICA

29. The Regional Committee was founded in 1973 and currently has members from twelve countries (ref 28). Its secretariat has been located in the Kenya Academy for the Advancement of Arts and Sciences. In May 1979, the Committee submitted a project proposal to UNDP concerning the development of a "regional network of S&T information in Eastern Africa" (ref 29), which may be summarized as follows:

The Council's secretariat would expand into an operationally active body with technical, educational and managerial expertise. It would provide an effective team which, together with external consultants, could design and implement development programmes decided by the Council and funded in a manner to be determined in each case. These programmes would include:

a) Development of a comprehensive resource-sharing programme, leading to the standardization of bibliographic activities and to agreements on common regional products and processes (directories of experts and research projects, union catalogues, inter-library loans, copy delivery services, catalogues of indigenous publications ("grey literature"), etc).

b) Design of educational programmes both for manpower development (training of documentalists) and for the training of users in order to promote full appreciation of the potentialities of information and documentation services in science and technology.

c) Implementation of a number of pilot studies (either limited in time or continuing) to clarify "user needs and present utilization of resources", and "priorities and alternatives for regionally-based developments".

d) Possible activities to promote the use of internationally-marketed scientific and technical information and documentation services, and to gain access to scientific and technological information networks and other foreign sources of potential interest.

30. There are some implicit unresolved aspects which will be crucial to the future development of this project. These relate mainly to the legal and financial status of the Committee, the authorization of Committee members to make agreements on joint ventures, the willingness of cooperating governments to pursue such agreements at the institutional level, and the time schedule for national participation in the various project activities. It appears to the present consultant that, even if these questions cannot be settled immediately, a series of actions could nevertheless be undertaken at the regional level, assuming that appropriate funding and expertise were made available:

1) Development of co-ordination mechanisms for resource sharing.
2) Education of documentalists and users of information and documentation services.
3) Regional surveys of information resources and information needs.
4) Studies on resource improvement.
5) Studies on design and maintenance of databases specific to the region.
6) Studies on utilization of externally available information and documentation services.

Such activities can only succeed, however, if the national infrastructures, such as the proposed National Documentation and Information Centre in Kenya, are ready to participate actively so that the actual services provided locally may really improve as a result of regional cooperation.

VI. EXISTING LIBRARIES AND DOCUMENTATION SERVICES IN KENYA

31. A directory of libraries in Kenya was published in 1977 (ref 14) and an updated edition is now in preparation. Among approximately 100 libraries which are described, about a dozen represent the major resources of scientific and technological literature in the country. These include five University faculty libraries:

1) Agriculture (Kabete);
2) Natural Sciences (Chiromo);
3) Medical Sciences (Kenyatta Hospital);
4) Engineering, Social Sciences, Humanities (Main Campus); and
5) Kenyatta University College Library.

Other major libraries in the country are those of

6) the Ministry of Agriculture;
7) the Kenya Agriculture Research Institute (Muguga); as well as those of international organizations such as

8) ICIPE (the International Centre of Insect Physiology and Ecology);
9) ILRAD (the International Laboratory for Research on Animal Diseases); and
10) UNEP (the United Nations Environment Progamme).

32. In a review of University Library Policies (ref 15), it is stated that the purchasing power of the acquisition budget has decreased by a factor of two over a five-year period, despite increasing responsibilities associated with the growth of the academic system. Yet, the general impression of the present consultant is that, considering the volume of research, the funding of research libraries is relatively good. In order to solve the basic problems of scientific and technological information provision in a small R&D community (appendix 1), additional measures of a co-ordinative and somewhat non-conventional character have to be taken, aiming at the effective use of available resources, the introduction of new documentation

services and techniques, and the utilization of external services. Some ideas and plans for this purpose are presented in a development plan for the University Library (ref 15). This plan includes:

a) a new building with greatly increased space and improved technical services,
b) introduction of computer-based library management,
c) creation of a School of Library, Archive and Information Studies, and
d) creation of a University Press.

However, no details are given on the time schedule foreseen or on the present status of implementation.

33. In most libraries, except those of the international organizations, there is a lack of adequate photocopying equipment, which is a basic instrument for improving the utilization of library holdings. It is necessary to install modern equipment (e.g. Cannon or Xerox, for which effective service organizations already exist in Nairobi), and to introduce a financial system that encourages a functional use of photocopying in research and education.

34. Two further major problems concern the acquisition of journals: late arrival by surface mail and short series due to the recent inception of most collections. The first problem can be solved by an increased use of airfreight, facilitated perhaps by a joint acquisition scheme in conjunction with advantageous rates for bulk airfreight and the second by establishing mechanisms to search for older material through international agents and library contacts, and in urgent cases by microfilming volumes from other libraries.

35. The University Libraries subscribe to about 3500 serial titles. (There is a general allocation for serials, and a "book vote" is specified for each institution). It is difficult to estimate the total holdings in the research library system, but a figure of about 5000 would be a realistic approximation. In the mid-70s, a Union Catalogue of serials in research libraries in the East African Community (Kenya, Tanzania, Uganda) was compiled and

printed from a computer based file (in co-operation with the University of Western Virginia). There is an ongoing effort to update this file (a computer printout from 1978 lists 14,085 titles), but the project does not seem to have high priority, perhaps due to the difficulty of co-ordinating the preparation of input.

36. The National Library Services (ref 4 and 22) administer an expanding network of public libraries which at present has relatively little functional overlap with the research libraries. The NLS has apparently received a mandate and funding for the production of a national bibliography (a catalogue of publications printed in Kenya), which, however, would not cover scientific and technological documents published in journals or issued as reports. The question of eventual computerization, which would enable the preparation of cumulative and special indexes, has not been considered at this point.

37. The National Archives (ref 3) has recently begun preliminary work on an information service dealing with documents from ministries, government agencies and "parastatal" (semi-governmental) organizations which have not yet been filed in the National Archives by the respective organizations. This venture, possibly to be reformulated on the basis of a Unesco study (ref 36), is not presently sufficiently advanced to be assessed. It should be noted that access to this kind of "grey literature" (often hampered by various levels of confidentiality, restrictions on circulation, etc) is generally regarded as an important issue for information and documentation services (cf. e.g. ref 35), although to a somewhat limited extent in the science and technology area.

38. Certain "manual" information and documentation activities exist in the libraries at Kabete Campus and Kenyatta University College, in the form of acquisition lists (ref 17) for FAO documents (for which the Kabete library is a national depository), selected abstracts (ref 19) and special bibliographies (ref 18). The KARI library (Muguga) provided until 1977 a "current contents" service to agricultural research institutes in the East African Community, by sending out Xerox copies of tables of contents from current issues of important journals, and also offered some back-up in the form of copies of full texts. This service has to a large extent been discontinued.

39. A very ambitious documentation programme for the Ministry of Agriculture was developed following an FAO mission (ref 57). The objective of the resulting Kenya Agricultural Documentation Centre (KADOC, ref 20 and 21), is "to help people engaged in the development of Kenya's agriculture to identify and retrieve the specific information they need in their effort". KADOC deals mainly with "grey literature" which is catalogued, indexed (a computerized system is in preparation), and microfiched. A powerful set of equipment has been acquired (under the programme of the Overseas Development Ministry, United Kingdom), including a photocopier (Xerox 3100) and a semi-automatic microfiche camera (GAF).

40. There is some experience in Kenya with computerized retrieval services for bibliographic information, although not with on-line services. MEDLINE searches are offered by the British Council, and could also be obtained from WHO. This service is little used, perhaps due to insufficient promotion and the difficulty of defining profiles for off-line search which yield more information than the "manual" use of Index Medicus. ICIPE is using Commonwealth Agricultural Bureaux services to provide information on research profiles with a relatively unsophisticated search logic. During a one year period, an SDI service using the Biosis database was offered to ICIPE. KADOC is receiving printouts from searches performed at PUDOC (Netherlands). A number of individual senior researchers (in engineering, physics and biology) report using or having used computerized services through personal contacts.

41. There have been some educational efforts in Kenya related to information and documentation services and techniques. The Co-ordinating Centre for Regional Information Training, CRIT (ref 30, 32 and 33) set up by the Deutsche Stiftung für Internationale Entwicklung (in co-operation with KNAAAS) has concentrated its efforts on relatively low-level programmes directed towards administration and management. However, an advanced course (ref 31) was given in Aberystwyth at the College of Librarianship, Wales, in 1979. The East African School of Librarianship, Makerere, was for a long time the centre for library education in the region, but there does not seem to have been much emphasis on modern information and documentation

services and techniques (ref 38). For many years the school has not trained significant numbers of non-Ugandan students, which may be one of the reasons for the need of an academic library school in Kenya.

Brief workshops in documentation have been held in the Kabete library and in the National Archives (ref 23).

42. A number of scientific and science popularization journals are edited and published in Kenya:

1) East African Agriculture and Forestry Journal
2) Kenya Coffee
3) Tea in East Africa
4) Journal of the East African Institute of Engineering
5) East African Journal of Medical Research
6) East African Wildlife
7) Kenya Geographer
8) POST (Promotion of Science & Technology)
   Series A - Physical and Chemical Sciences
   Series B - Biological Sciences
10) Journal of Insect Science

No recent survey of publication policies, lead time for publication, or publication rate has been made.

It is important to note that much of the locally-produced science and technology material is circulated in the form of mimeographs or stencils, often of rather poor technical quality. An important improvement could be obtained by providing offset printing equipment, as well as high-quality photocopying equipment (for production of small print runs of working documents and reports), for use by the R&D community, possibly within a University Press organization.

VII. COMPUTER FACILITIES AVAILABLE FOR INFORMATION AND DOCUMENTATION APPLICATIONS

43. A survey of the use of computers in Kenya was carried out by an NCST committee in 1977 (ref 9). Since that time the situation has changed radically (in particular concerning possible computer applications for information and documentation service) by the installation of the new University Computer at the Computer Centre, Chiromo Campus. The following description of this facility is taken from reference 24.

44. The ICL 2950 ("mainframe") computer will comprise 1 megabyte of core memory, 600 megabytes of disc storage, four 9-track tape decks, a high-speed card reader, a graph plotter, a paper tape reader/punch and two line printers. In addition to the "mainframe" there are eight 7502 terminal controllers (remote processors) which will initially support 26 visual display terminals and 19 local hard copy printers. Two of the 7502 terminal controllers will have "floppy" disc facilities. All of the terminals will be connected by direct telephone lines from the building of the Institute of Computer Science at Chiromo through a cable to the telephone exchange on the main campus and hence to their individual sites.

45. The sites proposed for the terminals are as follows:

Main Campus
(Faculties of Arts, Commerce, Population Studies Institute)
Faculty of Engineering
Institute for Development Studies
University Administration
(Registrar's Office, Finance Office)
Chiromo Campus
(Faculty of Science, Medicine)
Kabete Campus
(Faculties of Agriculture, Veterinary Medicine)
Kenyatta Teaching Hospital
(Faculty of Medicine)
Kenyatta University College
(Department of Mathematics, Business Management)
Institute of Computer Science
(Institute Staff, Students, and Users)

46. In addition to compilers for the common programming languages (BASIC, FORTRAN, COBOL, ALGOL, etc.), and the extensive software for applications which has already been developed for the existing computer of the University, some new facilities will be available on the new computer, including SPSS (Statistical Package for Social Scientists). All software will be available in the conventional batch-processing mode, using punch card input. Users will also be able to gain remote access to the software through a powerful terminal multi-access system known as MAXIMOP which was developed by Queen Mary College, University of London (which operates one of the largest existing ICL 2900 series computer mainframes).

Users at the terminals will thus be able to use the BASIC programming language and other standard programmes in an interactive "real-time" mode of operation. Transaction processing software is also available to enable data to be entered and validated on the terminals rather than through conventional punch cards.

47. The University Computer holds great potential for use in developing computerized information and documentation services in Kenya, such as those being proposed by the NCST.

VIII. GENERAL CONSIDERATIONS ON THE DEVELOPMENT OF NATIONAL INFORMATION AND DOCUMENTATION SERVICES

48. Access to scientific and technological information, and the ability to select, apply and further develop appropriate scientific results, are necessary factors in effective national development strategies. The main problems in designing information and documentation services for this purpose in many developing countries are consequences of the small size of the R&D system. Even in large R&D systems, a comprehensive information and documentation service can only be achieved by resource sharing at the national level, and extensive use of external service centres like the British Library Lending Division and the Lockheed or ESA/IRS on-line search systems. Most fields are covered by a small number of specific information services: e.g., in chemistry the R&D community is dependent on continuity of the operations

of Chemical Abstracts and the Gmelin and Beilstein handbooks. In small R&D systems, the problem of resource sharing and linkage to external sources and services becomes more acute, since each R&D project needs full access to S&T information in its domain of concern. In order to provide a reasonably comprehensive information and documentation service on a reasonable budget, a carefully considered policy is needed. For such a policy, which must be dynamic in response to changes of emphasis in the R&D community, a number of components, which have already been foreseen by NCST, have to be developed:

1) An up-to-date survey of on-going research and associated information services in the country.
2) A core collection of periodicals (and other "primary" sources) and of principal bibliographic tools.
3) A union catalogue of periodicals and mechanisms to avoid unnecessary duplications in acquisition.
4) Adequate photocopy equipment and mechanisms for interlibrary copy (and loan) services.
5) User training for adequate use of available services.
6) Current awareness (SDI) and retrospective searches, either by arrangement with some external centre or directly (i.e. using a local computer or telecommunication links).
7) A referral service to experts, institutions and information services.

49. This is a short list of basic items found in any functioning national scientific and technological information system; and they are also recurrent in many development proposals for information services in developing countries (see e.g. refs 39, 40, 41, 42, 43). Many of the latter proposals reflect the generality of the above structure, and much of the analysis presented therein is equally valid in all the countries studied. What differs from country to country is the organizational structure appropriate in a particular case, taking account of the existing local R&D system, the system of higher education, and the system of science and technology dependent services. Therefore, it should be stressed that the issue is not really what should be done, but is rather the "shape" and "content" of each system component, i.e.

how to co-ordinate, reshape and supplement efforts to fulfil the desired function of each. The major problem of information in a small R&D system (see appendix 1) is that of combining locally-based and externally-based resources and services to provide the user with access to scientific and technological information approximating the situation in a large R&D system.

50. A large number of Unesco projects have been devoted to guidelines for important processes like inventories of information services (ref 44), inventories of R&D projects (ref 46), the management of referral services (ref 43) and the establishment of SDI services (ref 47). *The Encyclopedia of Information Systems and Services - A Guide to Information Storage and Retrieval Services, Data Base Producers and Publishers, On-line Vendors, Computer Service Companies, Computerized Retrieval Systems, Micrographic Firms, Libraries, Government Agencies, Networks and Consortia, Information Centres, Data Banks, Clearinghouses, Research Centres, Associations, and Consultants* (ref 48), shows the scope of available means from which to select an appropriate subset in building an information and documentation system.

IX. RECOMMENDATIONS: OBJECTIVES AND ORGANIZATIONAL STRUCTURE

The initiative of NCST in the domain of scientific and technological information may, considering the role of NCST in the development of science and technology-based activities in Kenya, be formulated in the following terms:

Principal objective: To create, by the co-ordination and development of local resources and of international contacts for the provision of scientific and technical information, an information and documentation service situation closely approximating the situation in a large, highly-developed R&D system. The emphasis should be placed on retrieval and provision of scientific and technological documents, generally without processing their contents.

Subsequent extension of scope can be foreseen in at least four respects as services develop and needs become apparent:

a) introducing information services on scientific and technical data (in a wider sense than mere document provision)

b) assisting in creating information and documentation services outside the area of science and technology

c) assisting in the development of lateral flow of scientific and technological information (i.e. outside the R&D community)

d) promoting regional co-operation in the area of information resources and services.

Special consideration should be given to the information and documentation services needed by NCST and its committees in carrying out their obligations regarding the promotion of science and technology and its applications in Kenya.

In order to create an appropriate mandate for actions serving the above objectives, the following recommendations are formulated:

Recommendation 1: The statutes of the NCST (ref 1) might be amended to include the explicit responsibility for the establishment of a dynamic S&T information policy and for the promotion, co-ordination and functional development of local information and documentation resources and the utilization of external information and documentation services.

Recommendation 2: The NCST Committee on Information and Documentation might be made responsible for overseeing the practical actions necessary to move the system of information and documentation services towards the realization of the principal objectives. This role would entail investigations of needs and options, the preparation of a basis for NCST policy and planning, negotiations towards co-operative agreements for the implementation of information and documentation policies and plans, and actual work to supplement and coalesce ongoing activities so as to form a unified functional information system.

Recommendation 3: As an instrument in fulfilling these responsibilities, the NCST might create, within its secretariat, an operational unit with functions including:

1) analytical studies and evaluations

2) secretariat work for programme co-ordination

3) actual bibliographic and compilation work to supplement that of other services in the country

4) development of computer applications for information and documentation services

5) development and introduction of new information and documentation services

6) development and introduction of programmes for the education of documentalists and users of the services

7) duties with respect to international contacts (national information focal point, referral services and clearing house functions)

8) technical services (reprography, printing, micro-filming, etc).

The Committee on Information and Documentation would serve as a steering committee for the unit, and would be responsible for its activities. The unit might be given the name of "Kenya National Documentation and Information Centre" possibly with the acronym KENDOC.

The above organizational structure holds several advantages: it emphasizes the support and involvement of the Government and the R&D community; it takes advantage of, and extends, the policy-making and the co-ordinative functions of NCST; and it explicitly avoids introducing new power structures or decision-making mechanisms that might antagonize present organizations and impede the development of joint ventures.

In the formative phase, the division of duties within the Centre should perhaps be rather flexible to enhance a functional evolution, taking into account the capabilities of the staff, and feedback from the R&D community. As the Centre becomes established, and the mechanisms for co-ordination and interaction in the national information and documentation system are consolidated, a natural organizational pattern might emerge, with departments for the different functions listed in recommendation No 3.

X. RECOMMENDATIONS: THE CENTRE AS A DRIVING FORCE FOR THE DEVELOPMENT OF INFORMATION AND DOCUMENTATION SERVICES

As noted earlier, the list of actions needed to improve resource utilization and the development of information and documentation services is quite well-known. The main issue is finding expedient procedures for their implementation. In a de-centralized organization, agreements have to be reached on objectives and strategies, on division of responsibility, on financial matters, and on operational mechanisms. What follows is therefore to be taken as preliminary suggestions which can subsequently be developed in detail and implemented selectively, once the organizational structure of the Centre and its overall plan and priorities are adopted.

Recommendation 4: Assessment of the local potential of the R&D system in science and technology in Kenya is important, both for the elaboration of an R&D policy and for the development of adequate information and documentation services. A total review of the R&D system - its history, structure, role in a wider social perspective, and the main trends of its development - should be carried out. Special consideration should be given to an investigation of present and potential science and technology information needs related to four main service areas:

Physical sciences/technology
Medicine/pharmacology
Agriculture/life sciences
Social sciences/economics

Information needs and resources related to social sciences are particularly ill-defined and pose extremely difficult problems from the point of view of establishing information and documentation services of interest to a range of users. Much of the information in this field bears essentially on local situations which in part explain the relatively low interest taken in the social sciences by database producers. The whole question has to be studied in depth for the Kenyan situation in order to obtain constructive and viable ideas for prospective information documentation services. In the remaining recommendations, discussion will therefore centre on the natural sciences

and technology. Some of the suggestions advanced are, however, easily adaptable to the case of social sciences, once definite service proposals can be discussed.

Recommendation 5: Related to the above study is the compilation of an up-to-date catalogue of ongoing and completed R&D projects and a companion catalogue of personnel actively involved in research and development. These catalogues should be computer-based and a system should be developed for file management, ideally with on-line updating and retrieval. The system should also be designed to produce the diverse selective printouts needed for studies on the R&D system (cf 1), and to facilitate the provision of information and documentation services to the projects and the referral of enquiries related to the projects. There are difficult problems involved in defining the area of R&D and the specific projects to be covered, and in classifying and describing the projects. A permanent secretariat is needed to co-ordinate and analyze input to the system (cf ref 11).

Recommendation 6: An up-to-date guide to information resources and services in science and technology available in Kenya should be compiled and published. It should give information on major subject areas covered by libraries, list available abstract and indexing journals, describe the types of individual-oriented or standard-profile-based information and documentation services provided, identify principal contacts for access to external services, etc.

Recommendation 7: The new Nairobi University computer provides unique opportunities for the development of information and documentation services. A strong effort should be devoted to the development of computer-assisted techniques in library administration and information services. This implies study of available software for file processing and records management on computers; system analysis of administrative processes and the proposed information retrieval operations; programming of the additional routines which way be needed for the input, processing and output operations needed for indigenous files, etc. To some extent, software packages already available can be employed with appropriate modifications.

Recommendation 8: A spectacular recent innovation which could be effectively exploited in Kenya is the introduction of computerized bibliographic searches of major international databases, combined with a document delivery system using local and external resources. Three features have to be noted:

a) such services are inseparably linked to educational and promotional programmes

b) there is always a degree of international dependence in the delivery of databases, external computerized searches, and document delivery

c) it is generally not possible to establish viable services on the basis of a short-time consultant mission. A combination of medium-term consultancy and bilateral/international co-operation is one approach which has been shown to be effective in overcoming the large number of obstacles involved (ref 56).

The present question is how to construct a computerized bibliographic service suitable for the practical situation in Kenya. The following strategy is suggested:

a) Training of at least three documentalists (with backgrounds in physical sciences/technology, medicine, and agriculture/life sciences) in appropriate advanced information and documentation centres. It is important to make such arrangements with centres or organizations which would be prepared to engage in a long-term co-operation plan.

b) Establishment of training programmes for the Kenyan R&D community in the use of "manual" search techniques of the major abstracting and indexing journals". The programmes would also present the lesser known abstract journals (for different user groups), the special possibilities inherent in each (e.g., Science Citation Index), as well as an overview of computer-based techniques for bibliographic search, both "current awareness" and "retrospective" (including structure of files, search logic, search strategies, and profiles for SDI services).

c) Establishment of co-operative agreements with appropriate centres abroad for computerized search services on important data bases. Pilot projects could also be run on the Nairobi Computer Centre, using selected data bases of particular importance. A decentralized organization for search services could be established at the national level, with international contacts ensured through the NCST Centre and sectoral service units run by trained documentalists, in the main campus library and the medical and agricultural faculty libraries respectively (these documentalists should be members of the NCST Centre staff in spite of their working location). Arrangements would be made with the main research libraries in Kenya and with a number of libraries abroad to supply back-up photocopies (or loans).

d) Continuous development of services, user training programmes, staff development, promotion of services and evaluation with feedback from users. The educational programmes might later be transferred to the planned Library and Documentation School in Nairobi University. User training should be extended to all postgraduate students and also to undergraduates in their last year of study. The NCST Centre should build up a reference library in "library and information science" in support of its development projects and educational programmes.

Recommendation 9: A survey of acquisition policies in research libraries, budgets and budget increase estimates should be conducted. Efforts should be made to create a climate favourable for a co-ordinated library development policy. Procedures should be developed for planned (functional) duplication of holdings and for division of responsibility for coverage. Rules for cancellation of subscriptions should be adopted, making possible take-over of cancelled subscriptions by other libraries, e.g., notifications in an I&D news bulletin (Recommendation 21). The relevant plan for the division of responsibility should be accompanied by the provision of efficient photocopy equipment in the major research libraries and extensive photocopy service in lieu of loans. Procedures for funding of photocopy service should be established, either through library overhead allowances or within R&D project budgets.

Recommendation 10: Procedures should be devised for the rapid acquisition of scientific and technological literature, including reports and other "grey literature". Present delays due to pre-payment of pro forma invoices might be reduced by opening accounts with principal bookshops abroad (e.g., in the United Kingdom, the United States of America and the Federal Republic of Germany. Savings could be made by acquiring journals through agents in the country of publication. Direct contact should be organized between the NCST Centre and centres like the National Technical Information Service (USA) (ref 49) and the Centre national de la recherche scientifique (Paris), etc. Photo-copies of urgently-needed literature could be ordered by telex from the British Library Lending Division or other major libraries, preferably channelled through the Centre so that many requests can be included in each telex message.

Recommendation 11: An up-to-date union catalogue of serials in S&T in Kenya research libraries should be compiled and published. This is an instrument for resource-sharing and for the elaboration of a joint policy for library resource development. It is already an ongoing project in the University Library. There may be a need for a permanent secretariat to co-ordinate input from participating libraries. Considering the availability of the new university computer, it may be appropriate to design a new system for the computer processing of the union catalogue, with options for on-line up-dating and retrieval, production of sectoral lists, etc. The on-line search option would facilitate programmes for back-volume acquisition, and programmes for the avoidance of unplanned duplications or for the cancellation of titles available in Kenya.

Recommendation 12: There is a need for improving serial holdings by the acquisition of back volumes. Procedures for acquiring the original printed version, (or microfiche as alternative) should be developed. If necessary, missing issues or even full volumes could be microfiched cover to cover, in order to keep a collection complete. The Centre could establish contacts with firms and other organizations providing second-hand journals in science and technology, and also with libraries adhering to a common depository storage plan for older literature and therefore regularly weeding out their collections.

Recommendation 13: Special bibliographies and document collections may be needed. The usefulness of major bibliographic data bases for information and documentation services in Kenya should be investigated and the need for supplementary databases, specifically concerned with problems of the Eastern African region or the tropical zone in general, should be assessed. There already exist some abstract journals devoted to such problems, e.g. Abstracts of Tropical Agriculture, and the Quarterly Bulletin of Tropical Diseases. The latter, however, is simply extracted from MEDLINE, and, so far, is not supplemented with extra material. A special document collection and bibliographic data base for information and documentation services on "insect pest management in the tropical zone" is presently planned by ICIPE, Nairobi. A similar service covering research on therapy and health delivery

in the field of "tuberculosis in the tropical zone" is under consideration by the Kenya Tuberculosis Investigation Centre. The survey on R&D system in Kenya and associated information needs (Recommendations 4 and 5) will give further indications.

Much of the material originating in the developing countries is published in local journals or circulated in a restricted manner as "grey literature". As a consequence, much valuable information is under-used, which gives rise to unnecessary duplication of work (and delays in the application of research results), and decreases opportunities for professional criticism of the work by the R&D community. The establishment of a number of special collections of documents and associated computer-based bibliographies might therefore be considered in applied areas of research. Such collections would be built up in the library found to be most appropriate in each case. The preparation of input to a bibliographic database would also normally be de-centralized, while the Centre would assist in the computer-related tasks, management work, and in establishing international contacts for document delivery. Some overlap of these databases with the "Science Index" (Recommendation 14) and the file of "Government Reports" (Recommendation 15) is to be expected.

Recommendation 14: It is recommended that NCST compile and edit a "Science Index" to identify scientific and technological publications and other documents produced by Kenyans and of interest to the R&D community in Kenya and elsewhere. Once again, problems will arise in connexion with the definition of the scope of "science and technology" on the one hand, and with the establishment of quality criteria on the other; their solutions will have to be worked out in terms of a policy for the promotion of indigenous research and the international dissemination of its findings. Computerization of this file will provide an opportunity to print a cumulative bibliography and associated indexes and special selected lists. Much of the material would also be included in the file of "Government Reports (Recommendation 15), and the "Science Index" could be produced with little extra effort, mainly on input of articles published in international journals by Kenyan scientists.

Recommendation 15: A "Government Reports" project should provide access to (and information on) local "grey literature", in particular to reports and other documents from ministries, government agencies and "parastatal" organisations; such reports are often referred to as a basic issue for information and documentation services in developing countries (cf ref 35). These documents are often produced in only a few copies or in small mineographed (stencilled) editions. The volume of material of potential interest and relevance for retrieval and dissemination to the R&D community is not known and should be investigated. Special consideration has to be given to procedures for selection and problems of confidentiality and other restrictions on circulation, obsolescence etc. Possibilities of sectoral de-centralization in building up special collections (within a co-ordinated scheme with common criteria) should be investigated, and the present activities at the Kenyan Agricultural Documentation Centre (KADOC) should be taken into account. A joint computerized file of bibliographic data on "Government Reports" might be designed and set up with de-centralized input, allowing for retrieval in a cross-sectoral manner. Some overlap with "Science Index" (Recommendation 14), and "Special Bibliographies" (Recommendation 13) is to be expected.

Recommendation 16: Present services and needs concerning patents and standards should be investigated, and suggestions for improvements should be solicited from the users and derived from analysis of the international service situation. The NCST Centre might be given responsibility with respect to international contacts in this field and to the development of national computer applications to facilitate access to this information.

Developments in the area of non-bibliographic databases in science and technology should be closely followed in the literature and by contacts with suppliers, and managers of network nodes. The Centre should play an important role in identifying database services that could be useful to the R&D community in Kenya, and should take measures to introduce an awareness of such services by means of pilot projects.

Recommendation 17: The role of the research libraries, and associated information and documentation centres and systems, in the "lateral" flow of scientific and technological information (i.e. from the R&D community to public administration, science and technology-related public services, technical education programmes, extension services for industry, agriculture and health delivery) should be investigated. The organizational framework and present procedures in Kenya for processing the content of scientific and technological information such as "repackaging" and scientific writing for non-professionals, might have to be reviewed and measures taken for upgrading and widening such services. The NCST Centre may be able to contribute to these efforts though its international contacts, at least to comparative studies.

Recommendation 18: In order to carry out the tasks assigned to the NCST and its Committees, there will be a regular need for information analysis in the form of surveys, reviews, state-of-the-art reports, evaluations etc., covering specific areas in science and technology. These activities require deep insight and experience on the part of the person responsible, and often entail contacts with international centres of excellence to bring the studies to the forefront of research. This cannot be a task for an information and documentation centre, but rather will require a pool of R&D staff involved in the cooperation of different research projects, and willing to take commissions to perform such analyses. The organization and maintenance of such a referral activity could be entrusted to the NCST Centre.

Recommendation 19: The question of a translation service is often evoked in discussions on information and documentation centres. Two different objectives for such services have to be considered separately. One is to supply material for lateral information flow, mainly from internationally used languages such as English, to local idioms, which is not within the presently considered scope of activities of the Centre. The other objective is the supply of translations of science and technology documents judged by a scientist to be of high relevance to him, but published in a language he cannot understand. Using already published or otherwise available translations (e.g., those located in the list Journals in Translation and the indexing

journal World Transindex, both published by the International Translation Centre in Delft, Netherlands), it may be possible to reduce the need of actual translation considerably. The NCST Centre might arrange to obtain copies of translations identified in the sources mentioned. In addition, it could organize a pool of individuals, preferably with some background in science and technology and with adequate knowledge of the languages concerned, willing to take on commissions to translate abstracts or texts of documents. A personal (or telephone) contact between user and translator will in many cases considerably reduce the volume of translation which is really needed in finalized, written form.

Recommendation 20: A number of functions relating to international contacts could be effectively channelled through the NCST Centre. Some of these are:

a) Focal point for information on science and technology in Kenya, in contact with organizations in the United Nations family and other international, regional and national bodies.

b) Referral service on science and technology matters, directing engineers to appropriate institutions in Kenya in response to queries from abroad.

c) Referral service for queries from organizations which are not dealt with by local libraries and information services (most referrals would be expected to involve directing users to foreign and international sources of information which are little-known in Kenya).

d) Establishment and co-ordination of search profiles of Kenyan R&D personnel for current awareness services and retrospective search services from co-operating centres abroad. Generally, the Centre might also deal with questions of international co-operation and agreements in information and documentation matters, including subscriptions to files on magnetic tape, and possibly services for users abroad based on special files produced in Kenya.

e) Clearing house service, i.e. channelling of requests for science and technology documents of Kenyan origin, possibly identified by means of the "Science Index", "Government Reports" file and "Special Bibliographies" discussed earlier.

f) A general responsibilityto co-operate with information and documentation centres in science and technology in the region of Eastern Africa on matters of resource-sharing, educational programmes for documentalists and users and in the development of computer-assisted techniques in library and information work. The Centre might also serve as a focal point for Kenya as regards efforts made to establish a co-operative network of information and documentation services in Eastern Africa.

Recommendation 21: The NCST Centre might edit and publish a news bulletin for the promotion of information and documentation services. This could be used to announce training courses, seminars and workshops, to describe different bibliographic files and available services, to solicit contributions to the files suggested in Recommendation 13-15 for compilation and production in Kenya, to announce new journal subscriptions and suggested subscription cancellations (feedback from readers could confirm or refute hypotheses of low frequency of use) etc. The bulletin could also be used to provide more general information on NCST activities, on policy studies, project proposals and generally on the development of the R&D community in Kenya and its regional and international contacts.

XI. RECOMMENDATIONS: STAFF, CONSULTANTS, EQUIPMENT AND FUNDING

Recommendation 22: Staff

The following minimum staff is recommended for an effective information and documentation Centre designed to supplement and co-ordinate the national information resources in science and technology along the lines suggested in the present report:

a) Head of Centre (1) with an advanced degree in science or in information work, preferably at the doctoral level, and with considerable experience in research and in the use of computerized information and documentation services; some administrative experience is desirable.

b) Administrative assistant (1) dealing with the Centre's administrative matters and the management of its individual projects. He would also be responsible for maintaining the international contacts of the Centre.

c) Secretaries/typists/stenographers (2), also dealing with input to computer-based files. A good knowledge of English is required.

d) Librarians or documentalists (2), with a science and technology background, to perform compilation projects and associated computer-input.

e) Scientific officer (1) for manpower studies and the management of the national register of R&D projects and personnel.

f) Computer programming analyst (1) for software maintenance and development. A second analyst may be necessary to provide back-up as computerized services develop.

g) Specialized documentalists (3) with backgrounds appropriate to information and documentation services in Physical Sciences/Technology, Medicine, and Agricultural/Life Sciences. External training in an appropriate operational information centre will be needed. They will be placed at specialized service points in the decentralized information system of Kenya.

h) Technician (1) for photocopy, microform products and offset printing.

i) Driver

Recommendation 23: Consultants. The following external consultants are recommended to assist in the development of the Centre:

a) Expert on introduction, promotion and management of computer-based bibliographic search services and on design of new files for search services. At least 6 man-months of work is required in co-operation with local research librarians and the three specialized documentalists of the Centre, after their external training.

b) Systems engineer for system and software developments. Not less than 6 months, including recruiting and training of the Centre's own systems engineer.

c) Expert on education and training in information and documentation services for documentalists, librarians, R&D staff and university students. One short mission is recommended for curriculum development and production of educational materials, and several additional periods of several weeks to help conduct the first short training courses and user workshops of the Centre.

d) Expert on studies of structure, development and information needs in higher education, the R&D community, and science and technology related industry in developing countries. About 2 man-months of work should be foreseen, with appropriate local assistance.

e) Expert on the production and management of science and technology related "grey literature" in developing countries and associated information flow and use, with specific emphasis on documents in government administrations. About 3 man-months work is recommended, with appropriate local assistance.

f) Expert on lateral flow of science and technology information in developing countries, with specific emphasis on the role of administrations, secondary education, and extension services in agriculture, industry and health delivery. About 3 man-months should be foreseen, with appropriate local assistance.

Recommendation 24: Equipment

The following equipment should be obtained in order to implement the programme of the Centre:

a) One Canon 5500 (or Xerox 3100) photocopier for the different Centre activities and services to NCST and Committees. Possibly also five Xerox 3100 should be placed in major libraries (Main Campus, Chiromo, Muguga, Kenyatta Hospital, Kenyatta University College) to improve the inter-library loan system and the back-up system for search services.

b) One Gestetner Offset 210 printing machine with accessories, for the Centre's projects (production of bibliographic products, information bulletin, etc) and printing services for NCST and its Committees.

c) One microfilm camera (Gevaert or similar) for jacket microfiche production, as well as a microfiche duplicator and two microfiche readers (3M). The KADOC GAF microfiche camera might be used for bigger jobs on agreement. Possibly 10 microfiche readers should be

placed in the five libraries mentioned in a) above, if these cannot be accommodated in the respective library budgets.

d) Three IBM (or similar) "golf-ball" electric typewriters for the Centre's secretariat and projects.

e) Two display terminals connected to the University Computer Centre, for software development, input to files, and word processing for the production of the Centre's and NCST's documents. Software for word processing may be already available on the University Computer or may have to be partly developed.

f) One daisy wheel printer (45 characters/sec) and one fast matrix printer (about 200 characters/sec) to produce hard copy computer output at the command of the two CRT-terminals.

g) One office car.

Recommendation 25: Funding

Funding is required for equipment, staff, experts, external training programmes and travel. Further, there should be allowances for all projects and programmes run by, or co-ordinated by the Centre.

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    b) Report on the 7th Meeting, 18-20 April, 1978
    c) Recommendations from the 7th Meeting
    d) Minutes of the 8th Meeting, 27-29 November, 1978
    e) Minutes of the 9th Meeting 2nd to 4th April, 1979

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APPENDIX I

The problem areas of small R&D systems - a view of the present consultant

Reviews and analyses of research systems and information systems in a number of developing countries with small R&D systems demonstrate that, within the present organisational infrastructure and with conventional methods of resource sharing, a successful programme for a co-operative network of research libraries can be established. In addition, with a relatively modest increase in resources for equipment and a slight restructuring of procedures, many improvements could often be attained. Yet, it is clear that such systems only ensure utilization and maintenance of the local information resources. In spite of such improvements, some of the basic deficiencies remain, mainly related to the lack of timely access to science and technology information of foreign origin.

It is readily understood that the isolation of a research system due to lack of personal contacts, and more generally due to distance from the international centres of research and research communication, makes it difficult to remain on the forefront of research. It also follows that the lack of direct communication links cannot easily be compensated for by other sources of information. The predicament of such an information provision system can be characterised as a "small system syndrome" with many different aspects and implications. Some are easily recognized:

a) Inadequate resources. Even when a reasonable fraction of the total R&D expenditure can be allocated for information and documentation activities, it often is impossible to maintain a sufficiently comprehensive library service, even within a co-operative programme for sharing resources. Important abstracting and indexing journals are available only at one (or at best very few) places in the country. A more efficient use of funds is hampered by administrative difficulties. The shortage of funds and the distance from international centres contribute to the isolation of the science and technology system.

b) Fragmentation of efforts. The tendency towards the fragmentation of resources into non-viable or barely viable units with unclear objectives, and the ambition to reflect (on a miniature scale) the whole spectrum of organizations, associations and activities that can function autonomously only on a larger scale are two of the negative aspects of a small system. It would seem that a prerequisite for the successful implementation of advanced information and documentation services is a clear statement of objectives for R&D, a clear distribution of responsibility between the units involved in science and technology information transfer, allocation of necessary resources, and co-ordination in planning and performance of R&D services.

c) Too weak links with foreign information and documentation centres. Despite the existence of a large number of bilateral, regional and international agreements and programmes for information transfer, sometimes sponsored by international or regional organizations including for example information and documentation services in Africa explicitly

operating on a regional level, inadequate results have often been obtained, except for specific areas and projects. One reason is that the division of responsibility among the cooperating parties has not always been clearly established. Each party should ensure in such cases that a statement of rights and responsibilities is arrived at in advance and that the external services needed during a certain period are provided.

Adequate international information dissemination can save a large amount of resources for each Member State by avoiding duplication. In the many national contributions to UNCSTD (United Nations Conference on Science and Technology for Development, 1979), and in the recommendations of the Conference, the problem of access to the world's resources in science and technology information was given serious consideration. This is exemplified by a proposal in the contribution from SriLanka that the United Nations establish a "Global Centre for STD (Science and Technology for Development) Information Exchange", especially for the developing countries. In addition, Regional Centres would be established under the umbrella of United Nations Regional Commissions to further emphasize the information exchange unique to the region. The objectives of this overall effort would be to:

1) *make available to the developing countries all the available STD information to assist in their development;*
2) *produce STD information in developing countries to reduce the cost: e.g. books could be reprinted in a given region for distribution to developing countries in that region;*
3) *distribute STD information, on a shared-cost basis, to Member States, individuals and organizations;*
4) *create and produce an abstract journal primarily concerned with STD;*
5) *assemble a global STD information file available for retrieval by members for their own R&D efforts on a cost recovery (non-commercial) basis;*
6) *create a global depository for all published STD information;*
7) *negotiate with commercial owners of information (commercially-produced books, tapes etc.) for its reproduction in and distribution to the developing countries.*

The proposals in the present report for the development of science and technology information services in Kenya could be seen as creating a national information and documentation services situation that would contribute to the objectives of the proposed "Global Centre". It is possible to do this on a scale corresponding to the growth of demand, and to operate by combining regional efforts and external services.

The feasibility of this venture should, however, be accompanied by some words of caution. The existence of instruments and financing for comprehensive information and documentation services does not necessarily imply that they are effectively available and used to their full capacity. Basically, there seems to be a need for a reorientation of attitudes towards the provision and consumption of science and technology information. Users have to be made more literature-minded (and conscious of the duties and objectives of research libraries) and the

library staff more service-minded. This is not a simple and rapid process. Rather, it is part of the development of the entire local science and technology system as it becomes linked to its international counterparts. These ties create increasing demands from the research community for the timely provision of current literature, and thereby new demands on the research libraries and information and documentation centres. The development also fosters a better awareness of the value of information.

d) Service provision from developed countries is too expensive. The general photocopy service from the British Library Lending Division (BLLD) is expensive in terms of Kenyan library budgets, especially since service coupons, which were offered until recently as part of the Overseas Development Ministry (ODM) literature programme, have now been discontinued. International computerized services in science and technology information retrieval are not used systematically due to pricing, lack of contacts and lack of experience. An exception is medicine, where computerized searches (MEDLINE) are offered free by the World Health Organization (WHO), although with only limited back-up service for photocopies. The WHO service is not used much in Kenya, probably due to insufficient marketing and feedback of evaluations, and also because of the small size of the community of potential users.

e) Lack of equipment. Photocopying is today an indispensable facility for the provision of scientific articles to R&D personnel, and the only way of effectively sharing resources within the research library system. At present, very few machines are available in research libraries in developing countries, and those that exist are mostly obtained from foreign aid funds. The situation would be greatly improved by supply of photocopy equipment to the large research libraries. Further, printing of various bibliographic products is done by stencil on very poor paper. A number of small or medium-size offset machines would substantially improve the production. Microfiches cannot be used extensively due to lack of readers, and this problem could easily be solved by a relatively small investment from foreign aid funds.

f) Lack of educational programmes in modern information and documentation techniques and ideas. Library education in most developing countries, including Kenya, is, understandably, rather conventionally oriented towards "classical" librarianship. There is a need for special courses in modern information and documentation techniques and ideas, and user training programmes for increasing awareness of services in the entire community of potential users. Courses should be constructed from a wide spectrum of modules that could be combined ad hoc according to the various needs and levels, (for undergraduates, postgraduates and research staff, technical civil servants in Government Departments, R&D-oriented engineers etc., or for library assistants, librarians and the new profession of documentalists). For such programmes, the necessary textbook materials and the conducting of initial courses have to be worked out in co-operation with experienced educators in the information and documentation field, not available in Kenya. Quite a few documentalists will have to get some kind of training and operational experience from active information and documentation centres abroad.

It can be concluded that these problems can often be solved only in part by the self-improvement of the local system and the provision of additional equipment and personnel. What is needed in many cases is a massive input of external services and external expertise to create a new information provision situation in which access to the world's science and technology results would approach that of the developed R&D systems. One option which should be considered is that of bilateral co-operative agreements with advanced information and documentation centres that are willing to take on responsibility to carry out development work and help support the establishment of a co-operative network of national information and documentation resources. This evolution can certainly be enhanced by efforts in training and education of librarians, documentalists and all categories of users of science and technology literature. But it would be unrealistic to expect a radical change of attitude towards such literature or a sudden emergence of new (latent) needs following the offering of new services.

One of the main problems facing innovation in this area is that of assessing potential needs. Since the researcher has to adapt his work to the prevalent situation, he will suppress those needs that cannot be fulfilled, and therefore new requirements will emerge only as new facilities are made available. The process of transition to a "Westernized" system of information provision will certainly not be smooth, nor will it be met by unanimous enthusiasm on the part of all of those for whose benefit new services are maintained. However, once a decision is reached concerning the level at which the services should be developed, education and training should make the user community responsive to the need to keep abreast of the world literature in science and technology, and to the community's responsibility to meet this need.

The active search for potential information needs, the promotion of an awareness of the necessity to take new options for their fulfilment and the fostering of a higher level of literature-mindedness and service-mindedness are all important aspects of the development of the small R&D system to a level where it can fit organically into the international system.

But it must be observed that the "small system syndrome" that besets the system of information provision for research, has its counterpart in the research system itself. This has recently been candidly analysed by M. Moravcsik and J. Ziman (ref 53). A series of factors are identified that combine to prevent the efficient use of the scarce resources available for research and development and that tend towards fragmentation rather than co-operation. While in some areas over-emphasis on centralized control makes research management difficult, in others, the lack of co-ordination of policy and operations gives rise to the inefficient use of resources and even enhances the "small system syndrome". International organizations themselves should perhaps help by co-ordinating their programmes to attain economies of scale that would enable implementation of systematic development schemes, fragments of which could not form viable sub-units. On the other hand the projects acceptable by local authorities must necessarily conform to the current organization of R&D in a given country, and external inputs may even show a tendency to consolidate the very structures that

ought to be reshaped in order to provide a framework for long-range development. Some attention should be given to these problems in each national situation where international assistance is required, so that a balanced and diversified set of actions can be planned.

There are other important limitations that should be taken into consideration in order to bring expectations of the impact of information and documentation services to a realistic level. Even if the R&D system is organized in such a way as to make the best possible use of available resources by means of adequate administrative processes, co-operative schemes and functional objectives; and even if an information and documentation service providing timely access to the world literature could be established (which would also raise the users' general level of "literature-mindedness"), some aspects of the "small system syndrome" would not easily be eliminated or by-passed. One is that, because of lack of expertise in many areas, many solutions to problems may not be found in spite of availability of "information". A still more fundamental problem has to do with the role of documentation in the development of science and technology. In a sense, literature is often more an effect of scientific advance than its cause. The meaning of this statement is that, in highly developed R&D systems, there are a multitude of channels of information which work in a complementary or redundant way, whereby the literature (published research reports) is a very late offshoot of information flow. Other ways of communication are so important and rich in relevant information that the access to published reports is not enough to compensate for the non-access to the other resources. For example, it is well-known that research papers tend to give a polished picture of the research process and do not in general report failures and obstacles that add significantly to the experience described in the successful results. Another example concerns the evaluation of significant scientific discoveries which, in spite of the supposedly open critical debate in science, tend to be substantiated by means of informal communication in invisible colleges.

For similar reasons, a R&D system that does not include a sufficiently broad research programme will not be able to assimilate research results for application either. A viable R&D system, like an organization, is dependent on a subtle interplay of different channels of information, some tacit, informal or hardly conceptualized, and which together provide a basis for scientific development.

To use a metaphor, the documentation of R&D is related to the R&D system somewhat like the top of an iceberg to its submerged part: it would be senseless to try to transfer the top alone believing that it could grow a new base (i.e., the transfer of scientific and technological information does not by itself guarantee the growth of a socio-technological infrastructure). This is truer in technology than in science, due to the facts that reporting has a more restricted role in the development of technology than it has in science, and that economic restrictions hamper the free flow of technological information.

The present consultant's conclusion is that policies for allocation of resources for scientific and technological information systems should be based on realistic appraisals of potential for information system development and use. Although it is possible to create an information provision system designed to be as efficient as those services offered in developed R&D systems, it will not fulfill its purpose unless care is taken to develop the capability of the R&D system to meaningfully exploit the information services provided.

In order to decide on an appropriate level of system operation, it would seem advisable to carry out more thorough study of potential needs and requirements. This could be done in the form of committee work similar to that recently presented as the report on "Scientific and Technical Information Provision in Sweden" (ref 54), but with emphasis on the particular problems facing R&D in Kenya.

APPENDIX 2

List of meetings during the Mission

3 September 1979	National Council for Science and Technology (NCST) Prof. P. Gacii (Secretary) Miss I. Kamau (Programme Officer)
	Unesco Regional Office Dr R. Maybury
	International Centre for Insect Physiology and Ecology (ICIPE) Prof. T. Odhiambo (Director)
	Kenya National Commission for Unesco Mr F. Ng'ang'a (Secretary General)
4 September	NCST Miss I. Kamau
6 September	ICIPE Prof. A. Tahori (Director of Research) Prof. E. Smith Mrs R. Ortega (Documentalist) Mr D.R. Kigera (Librarian)
	University of Nairobi - Science Faculty Library (Chiromo)
7 September	National Archives Dr M.D. Kagombe (Director) Mr D. Lyle (Deputy Director)
8 September	University Library (Main campus) Mr J. Ndegwa (Director)
10 September	Ministry of Agriculture Library Mr N.D.K. Njoroge (Librarian)
	Ministry of Agriculture - Kenya Agricultural Documentation Centre (KADOC) Mrs E.K. Muthigani (Director)
	University of Nairobi - Faculty of Engineering Prof. P.M. Githingi (Department of Mechanical Engineering)
11 September	Kenya National Academy for Advancement of Arts & Sciences (KNAAAS) Prof. C.P.M. Khamala (Chairman) Mr F. Inganji (Programme Officer)
13 September	University of Nairobi - Medical Faculty Library Mrs R.M. Kiathe (Librarian)

Kenya Agriculture Research Institute (KARI) Library, Muguga
Mr D. Njoroge (Librarian)

Ministry of Agriculture - Agricultural Information Centre
Mrs V.O. Kaya

17 September — Kenya National Library Services
Mr R. Oluoch (Director)

Kenyatta University College Library
Mr J.R. Njuguna (Librarian)
Mrs E. Kisule (Librarian)

18 September — University of Nairobi - Faculty of Agriculture & Veterinary Medicine (Kabete)
Dr S.O. Keya (Dept of Soil Science)
Mr S. Durrani (Librarian)

19 September — University of Nairobi - Faculty of Science
Prof. M.S. Alala (Mathematics, Dean of Faculty)
Dr S.F. Dossaji (Botany)
Dr I.O. Nyambok (Geology)
Dr R.W. Mwangi (Zoology)
Dr P.M.R. Kiangi (Meteorology)
Dr J.M. Ndombi (Physics)
Dr A.H.S. El-Busaidy (Chemistry)

British Council Library
Mrs P. Watts-Russell (Librarian)

20 September — ICIPE
Prof. A. Tahori
Prof. E. Smith

21 September — Coffee Research Foundation Library (Ruiru)
Mr J. Temwa (Librarian)

Kenya Library Association (NATIS Committee)
Mrs B. Pfukani (Univ. of Nairobi Library)
Mr A. Rampuri (Kenya National Archives)
Miss N. Kagondu (Inst. of Development Studies, Univ. of Nairobi)
Mrs R. Thomas (Library of Congress, East African Office, Nairobi)
Mr Z.N.B. Kanaiya (Kenya Institute of Administration)

24 September — Univ. of Nairobi - Department of Computer Science (Information Processing)
Prof. B. Scott

Industrial Survey and Promotion Centre
Mrs S. Alambo (Programme Officer)

	Government Chemist's Department Mr N. Muraguri (Director)
	Medical Research Centre (Department of the Royal Tropical Institute, Amsterdam)
25 September	Library of Congress, East African Office Mr J. Armstrong (Director) Mrs R. Thomas (Librarian)
	Unesco Regional Office Dr R. Maybury
26 September	International Laboratory for Research on Animal Diseases (ILRAD) Mr P. Imende (Librarian)
27 September	NCST - Committee on Documentation and Information Prof. P.M. Mbithi (Chairman) Prof. P. Gacii (NCST) Mrs E.K. Muthigani (KADOC) Prof. C.P.M. Khamala (KNAAAS) Dr J. Gikonyo (Ministry of Health)
	Coordination Centre for Regional Training (CRIT) Dr T. Moeller (Director) Mr F. Inganji (Programme officer, KNAAAS)
28 September	Kenya Tuberculosis Investigation Centre (KTIC) Dr S. Kamunvi
29 September	KTIC Dr J.A. Aluoch (Director) Dr S. Kamunvi Mr E.A. Edwards
2 October	ICIPE Mrs R. Ortega (Documentalist) Prof. A. Tahori (Director of research)
	UNDP Office Mrs P. Mboya
	Unesco Regional Office Chief Olu Ibukun (Director of Regional Office)
3 October	ICIPE (Research staff meeting) Prof. E. Smith (Crop borers) Mr D.R. Kigera (Librarian) Prof. A. Tahori (Dir. of Research) Dr A.K. Raina (S.s. fly) Dr Z.T. Dabrowski (Basic plant resistance) Mrs R. Ortega (Documentalist)

Dr E.D. Kokwaro (HSFRU)
Dr D.L. Whitehead (CBRU)
Miss E.N. Kahuhu (Library assistant)
Dr P.G. McDowell (CBRU)
Dr J.V. Clark (SPRU - Sorghum Physiology Research Unit)
Dr A. Challier (Tsetse)
Dr M.F. Chaudhury (Tsetse)
Dr F. Obenchain (Ticks)
Dr W.L. Nutting (Termites)
Dr S.M. Waladde (DPRU)
Dr B.A. Otieno (Chemistry)
Dr T. Gebreyesus (Bioassay)

KNAAAS
Prof. C.P.M. Khamala

KTIC
Dr S. Kamunvi
Dr A. Dallas
Mr E.A. Edwards

Medical Training Centre
Dr M.R. Migue (Director)

Wellcome medical library
Mr P. Njagi (Librarian)

4 October — UNDP Office
Dr R. Kitchen (Resident Representative)

American Centre Library
Mr J. Yett (Regional Library Consultant)

5 October — Unesco Regional Office
Dr V.P. Kahr

8 October — KNAAAS
Prof. C.P.M. Khamala (KNAAAS)
Dr R. Hjerppe (Tanzania National Scientific Research Council - TNSRC, Dar es Salaam)
Mr I. Munisi (TNSRC)
Miss I. Kamau (NCST)

9 October — UNDP Office
Dr R. Kitchen (Resident Representative)
Dr V.P. Kahr (Unesco)